Math Diversion 936

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I love it when a plan comes together.
— Hannibal Smith, *The A-Team*

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Title: Question 22541
 Presenter: Patrick
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1 The Problem

[From the viewpoint of the questioner:] Help! I can't even think of a good equation for this problem! Brine is a solution of salt and water. If a tub contains 50 pounds of a 5% solution of brine, how much water must evaporate to change it to an 8% solution? Any help would be greatly appreciated!

I can tell you right off what a really good equation for this problem is: Every total is equal to the sum of its parts! Here's a good equation formed from that kind of analysis:

$$\text{(Wt. of brine before evap.)} = \text{(Wt. of brine after evap.)} + \text{(Wt. of water evap.)} \quad (1)$$

In the early stages of analysis of a mixture problem, a bad question to ask yourself is this: *I know what the unknown is. How do I relate the unknown to the given information?* Experience strongly suggests that the right questions to ask are these:

- What are the totals?
- What are the parts?
- What are the conserved quantities of a before-and-after process?

2 Solution

At least this problem also gives its data in terms of weights, so percentages make sense here, too.

We start with a tub with 50 pounds of brine in it. We will let some unknown amount x evaporate from it, leaving $50 - x$ pounds of concentrated brine in the tub. This is an equation! Let's show the process in a figure.

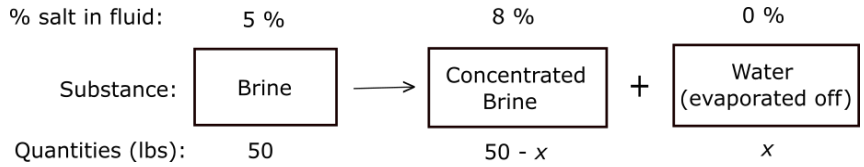

Figure 1. Standard setup for calculation: We've already shown the conservation of overall fluids in pounds.

We need just one equation, which we'll get from balancing on salt on both sides:

$$(.05)(50) = (.08)(50 - x) + 0x\,. \tag{2}$$

which has solution $x = 18.75$ pounds.